THE AMERICAN ORB-WEAVER GENERA *COLPHEPEIRA*, *MICRATHENA* AND *GASTERACANTHA* NORTH OF MEXICO (ARANEAE, ARANEIDAE)

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Abstract. *Colphepeira* has only one species from the southeastern United States. There are four species of *Micrathena* north of Mexico, three common ones in eastern North America from New England to the tropics, one uncommon from Arizona to Guatemala. All *Micrathena* known, perhaps 50 species, are tropical American, the three extending their range north belong each to a different species group. Even though tropical and widespread in the eastern states, *M. mitrata* and *M. gracilis* appear absent from southern Florida. All *Micrathena* species have only a sliver of the canoe-shaped tapetum left, the latter a characteristic of most of the superfamily Araneoidea. The cosmotropical genus *Gasteracantha* has only one or two species in the Americas, *G. cancriformis* in the warmer parts of North America.

INTRODUCTION

Homann (1950, 1971) reported diversity in secondary eye structure within the spider family Araneidae. The tapetum of the secondary eyes is usually canoe-shaped: with a crease through the middle dividing the tapetum into two parts facing each other (Figs. 4, 5, 75, 76). This is characteristic for members of the superfamily Araneoidea and some related families including Agelenidae, Gnaphosidae, Clubionidae, and Amaurobiidae. *Meta* and *Zygiella* have a large canoe-shaped tapetum, like Theridiidae, however the tapetum appears reduced in *Araneus* (and also *Colphepeira*, Figs. 4, 5) with rows of rhabdomes arranged in loops toward the median side in the posterior median eyes. In some (*Pachygnatha*, and also *Linyphia*) only the lateral eyes have the canoe-shaped tapetum left. *Tetragnatha* have lost all tapetum. Some arachnologists consider the absence of epigynum in *Pachygnatha* and *Tetragnatha* a primitive feature and the two genera ancestral, related to the haplogyne spiders. Out-comparison (all relatives have a canoe-shaped tapetum, and an epigynum) would indicate that the loss of both structures may be secondary. To learn more about these relationships, the tapetum has to be examined (Figs. 4, 5, 19, 20, 75, 76).

Already Homann's eye studies indicated that *Colphepeira* belongs to the Araneinae, not close to *Meta* or *Theridiosoma* as previously thought. My study of *Colphepeira*'s genitalia confirms Homann's conclusions. A new observation, not previously reported, is that *Micrathena* species have only remnants of a tapetum in the posterior median eyes. Perhaps this is only an adaptation to *Micrathena*'s diurnal habits or perhaps it will be of use for figuring out phylogenies.

Also of interest are the relatively large accessory setae below the tarsal claws of *Micrathena*. *Micrathena* may be a good experimental animal for studying the handling of silk (a subject about which we know little), because its setae against which silk strands are held by the median claws are larger than those of other genera.

[1] Museum of Comparative Zoology.

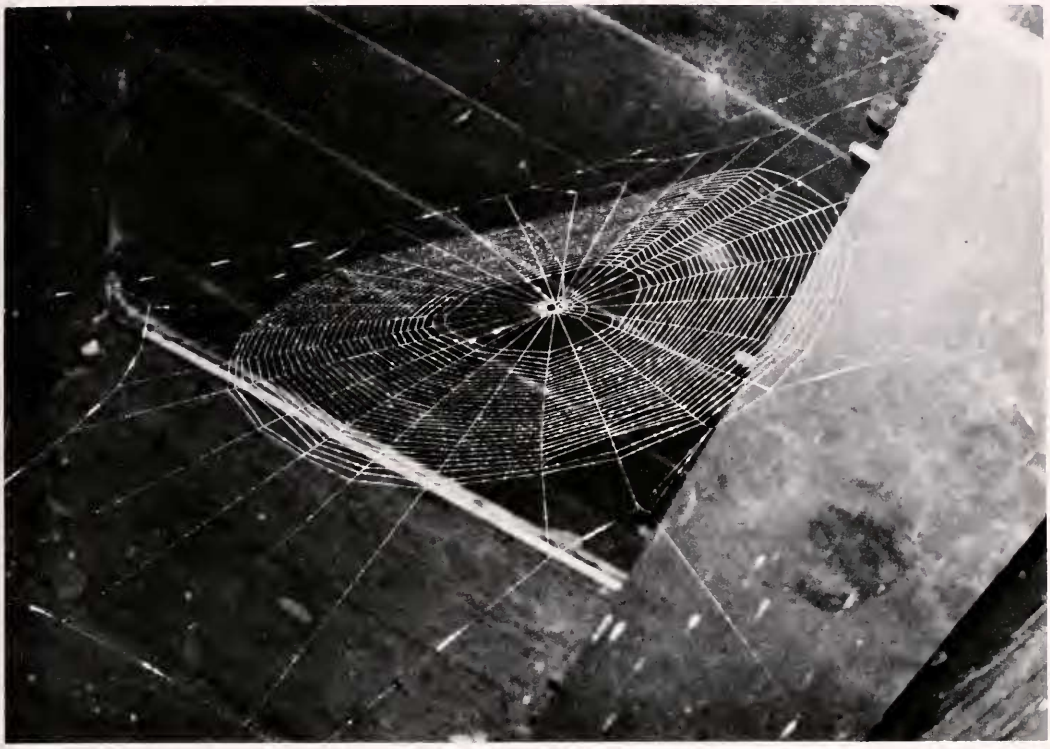

Plate 2. *Gasteracantha cancriformis* (Linnaeus) web, spider removed, dusted with cornstarch. Viscid area 17 cm in diameter. Web was built at 45° angle in porch corner of abandoned Florida house: lower left, floor; above and far right, walls. Notice tufts of silk on frame lines and on some radii.

Colphepeira contains only one small-sized species and is related to *Singa* and perhaps *Mangora*. *Micrathena* and *Gasteracantha* are tropical spiders; *Micrathena*, with more than 50 species, are all tropical American. Three of these have successfully extended their range from the tropics to temperate eastern North America (Map 2). Each of the three belongs to a different species group. I believe *Gasteracantha* and *Micrathena* to be specialized Araneidae which have lost some of their palpal sclerites secondarily, and *Micrathena* do not attack-wrap prey (Robinson, personal communication). The lack of attack-wrapping is probably not primitive but a secondary loss. *Micrathena* and *Gasteracantha* orb-webs have open hubs (Plates 1, 2). *Micrathena* rests in the center of the web in an unusual position (Plate 1) and controls web tension. Unlike other araneid genera *Micrathena* have strong fourth legs, used to hold its position in the web (Plate 1). Both *Micrathena* and *Gasteracantha* are diurnal spiders.

I would like to thank colleagues for

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Plate 1. *Micrathena gracilis* (Walckenaer) in web, Virginia. The lower photograph is about life-size. Web dusted with cornstarch. Notice the unusual position of the spider in the open hub and the use of the fourth leg (in upper photograph).

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METHODS

The method of examination, study, and illustration are those of other studies in this series on North American orb-weavers. However in *Micrathena* and *Gasteracantha*, measurement of total length is the length in midline from the anterior margin of the carapace to between the posterior abdominal humps or spines.

The tapetum of the secondary eyes was examined by near-vertical illumination (with a fiber-light) on the eye. The spider is kept submerged in alcohol and positioned on washed sand, which permits odd positions and very minor changes in angles. (Because of reflections, sand is a poor background for most observations; the background should be black.) The magnification of the stereoscopic dissecting microscope is about 50 times for the larger species, 100 times for the smaller. If the eye lens has become opaque in preservation the spider can be cleared in clove oil for examination. The posterior dorsal eyes were illustrated with the left eye flat and the right at an angle, anterior is on top (Figs. 4, 19, 75). The left lateral eyes were illustrated diagrammatically, first the anterior (left) flat under the microscope, then the spider was shifted for the posterior eye (right) flat under the microscope. The illustrations produced are thus composites (Figs. 5, 20, 76). The rows of rhabdomes can be seen in microscope mounts of the eyes with a compound microscope.

Following American and British dictionary definitions but not arachnological vocabulary, spines are immovable, rigid, pointed humps or thorns, as found on the abdomen of *Micrathena* and *Gasteracantha*. The movable heavy setae covering the integument are called macrosetae.

Colphepeira Archer

Colphepeira Archer, 1941, Geol. Surv. Alabama, Mus. Paper, 18: 12. Type species *Epeira catawba* Banks by original designation. The name is feminine.

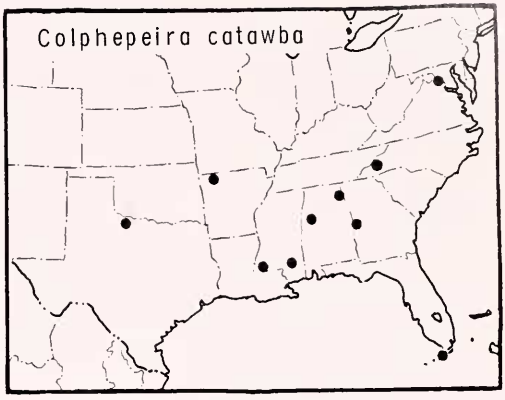
Diagnosis. Colphepeira differs from many other araneid genera by the closely spaced eyes (Figs. 1–3). Unlike *Mangora* and *Singa*, it has a hirsute carapace and abdomen with short setae on granules and the shape of the abdomen is higher than long with posterior dorsal tubercles (Figs. 1, 6, 7). It differs from *Mangora* by the lack of the characteristic long trichobothria on the third tibia.

Description. The carapace, abdomen, and legs are covered with scattered short setae. The setae are cylindrical, distally tapering to a blunt point, basally with a narrow neck and sitting in the center of a disc. The sides of the setae have some blunt teeth (Fig. 9). The eyes are subequal to each other in the female, and the anterior are larger in the male. The posterior eye row is recurved. The median eyes are slightly more than their diameter apart, and the anterior medians are less than two diameters from the laterals, the posterior medians 2.5 diameters from the laterals.

The thorax has a shallow depression in the female (Fig. 3) and a transverse, procurved mark in the male. The posterior part of the head is slightly swollen. The height of the clypeus is slightly more than the diameter of the anterior median eyes (Fig. 2). The sternum, like the carapace, is lightly sclerotized and slightly granulate. The chelicerae are weak, without a basal boss, and have two teeth on the anterior margin, two on the posterior and denticles and one tooth in between (Fig. 8). The chelicerae have a proximal anterior projection under the clypeus as in Theridiidae (Fig. 8). The proximal articles of the legs, especially the femora, are also slightly granulate. The first legs are longest, the fourth second in length, the third shortest. The metatarsus and tarsus together are shorter than the patella and tibia. The abdomen is higher than long with posterodorsal and posterior tubercles (Figs. 1, 6, 7). The lung covers are smooth and, like those of *Meta*, lack the transverse grooves found in species close to *Araneus*. The leaflets of the book-lung in a microscope mount appear to consist of series of parallel tracheae attached to each other side by side.

The males are like females, slightly smaller and have a more distinct, transverse, thoracic depression and a slightly higher clypeus, 1.5 diameters of the anterior median eyes. The endite has a tooth facing a tooth on the proximal end of the palpal femur. The distal margin of the first coxa has a hook that fits into a groove on the second femur. The legs are not modified except that the anterior tibia is slightly sinuous.

Genitalia. The soft epigynum is covered with setae (Fig. 9) and has a soft annulate scape (Figs. 9, 10). The openings appear on the posterior face (Figs. 10, 11). There are fertilization ducts. The male palpus has a soft conductor (C in Figs. 14, 15), bearing a basal tooth, a median apophysis (M), which has a hook, and a very large terminal apophysis (A) which covers conductor and embolus (E) distally. The terminal apophysis extends and covers most of the bulb laterally (Figs. 12–15).



Map 1. Distribution of *Colphepeira catawba* (Banks), north of Mexico.

Relationship. A similar large terminal apophysis (A in Fig. 15) is found in some species of *Singa* (Levi, 1972) and *Mangora* (Levi, 1975). The resemblance of the palpus (Fig. 14) to that of *Singa hamata* (Clerck) is striking in the shape of the small median apophysis (M), the soft conductor (C), and the large terminal apophysis (A). The embolus of *Colphepeira* is simpler, and *Colphepeira* lacks a subterminal apophysis. Other similarities to *Singa hamata* and *Mangora* are the lightly sclerotized epigynum, with a soft broadly attached scape and the closely spaced eyes. The genitalia also resemble those of *Cercidia* (except for *Cercidia*'s large median apophysis). All these related genera *Colphepeira*, *Singa*, *Mangora*, and *Cercidia* have the eyes relatively closely spaced, unlike those of the larger-sized *Araneus*, *Micrathena*, *Gasteracantha* and those of numerous other araneid genera. *Colphepeira*, unlike most araneid genera but like *Mangora*, does not have distinct contrasting ventral abdominal marks.

After he examined the tapetum of the secondary eyes (Figs. 4, 5) Homann (1950) first reported that *Colphepeira* is more

closely related to *Araneus* than to *Meta* or *Theridiosoma*.

Distribution. Only one species of *Colphepeira* is known, *C. catawba*, found in the southeastern United States (Map 1).

Colphepeira catawba (Banks)
Figures 1–15; Map 1

Epeira catawba Banks, 1911, Proc. Acad. Natur. Sci. Philadelphia, 63: 450, pl. 34, fig. 4, ♀. Female holotype from Ashville, Buncombe County, North Carolina in the Museum of Comparative Zoology, lost. There is no old E. B. Bryant catalog card in the file for this species as there is for other Banks types.

Aranea catawba:—Roewer, 1942, Katalog der Araneae, 1: 859.

Colphepeira catawba:—Archer, 1941, Geol. Surv. Alabama, Mus. Paper, 18: 13, pl. 1, figs. 3, 4, pl. 2, figs. 1–3. 1953 Amer. Mus. Novitates, no. 1622: 22, figs. 32–34.

Araneus catawba:—Bonnet, 1955, Bibliographia Araneorum, 2: 452.

Description. Female from Arkansas: carapace black with paired yellowish white patches lacking pigment. Sternum spotted black and yellow-white. Coxae yellow-white. Legs yellow-white with narrow black rings. Dorsum of abdomen with paired streaks (Figs. 1, 7). Venter with black and white spots and no distinct marks. The abdomen slightly higher than long, with four posterodorsal tubercles closely grouped on each side and a pair of tubercles on the posterior face (Fig. 7). Total length, 3.5 mm; carapace, 1.2 mm long; 1.0 mm wide. First femur, 1.2 mm; patella and tibia, 1.4 mm; metatarsus, 1.3 mm; tarsus, 0.5 mm. Second patella and tibia, 1.2 mm; third, 0.8 mm; fourth, 1.0 mm.

Male from Arkansas with color pattern less distinct than female. Abdomen shape like that of female. Total length, 1.6 mm; carapace, 0.9 mm long, 0.9 mm wide. First femur, 1.0 mm; patella and tibia, 1.2 mm; metatarsus, 0.6 mm; tarsus, 0.4 mm. Second patella and tibia, 1.1 mm; third, 0.6 mm; fourth, 0.7 mm.

Variation. Some specimens have little black pigment, others are almost completely black. Total length of females 2.2 to 3.8 mm; carapace 1.0 to 1.3 mm long, 0.9 to 1.1 mm wide. Total length of males, 1.6 to 2.2 mm; carapace 0.9 to 1.2 mm long, 0.9 mm to 1.0 mm wide.

Diagnosis. This species can only be confused with *Dolichognatha* species, which are of similar size and appearance. *Dolichognatha*, a relative of *Tetragnatha*, has four small tubercles on the abdomen, and *Colphepeira* has four tubercles posterodorsal on each side and in addition a pair posteriorly (Figs. 1, 6, 7). *Dolichognatha* species have their chelicerae elongate; *Colphepeira* do not (Fig. 2). The *Dolichognatha* epigynum has a depression with a dark spot on each side; *Colphepeira* has a fleshy scape (Figs. 9, 10). The *Dolichognatha* male palpus appears rather simple, *Tetragnatha*-like, but with a complicated paracymbium. That of *Colphepeira* has a terminal apophysis, median apophysis, and a simple paracymbium (Figs. 12–15).

Natural History. According to Archer (1941) *Colphepeira catawba* makes its horizontal orb-web near the ground between tree roots in thin open second-growth woods with grassy undergrowth. The web is 7 to 9 cm diameter with about 60 spirals and a small, poorly defined hub. The egg-sac hangs with debris, suspended on a horizontal line just above the web. The spider has its retreat under loose bark and feeds on small ants.

Distribution. Southeastern United States, Virginia, southern Florida to Sonora (Map 1).

Records. Virginia. Fairfax Co.: Great Falls, ♀ (N. Banks). *Georgia.* Troup Co.: West Point, 7 Sept. 1949, ♀ (A. Archer). *Florida.* Monroe Co.: 2 mi SE of Mara-

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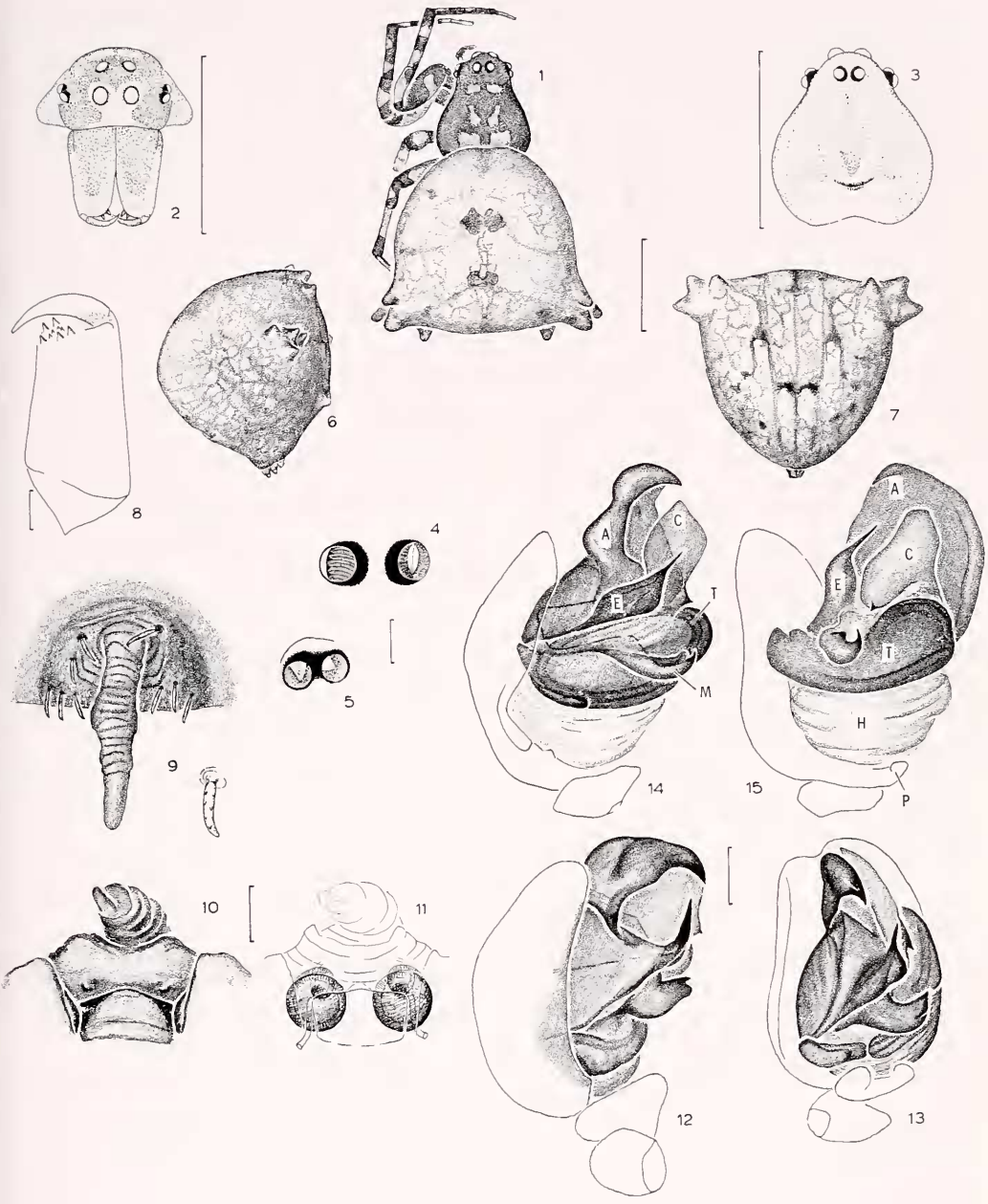
Figures 1–15. *Colphepeira catawba* (Banks) 1–11. Female. 1. Dorsal view. 2. Eye region and chelicerae. 3. Carapace. 4. Posterior median eyes. 5. Left lateral eyes. 6. Abdomen from side. 7. Abdomen, posterior view. 8. Left chelicera from posterior. 9–11. Epigynum (with enlarged seta). 9. Ventral. 10. Pos-



terior. 11. Posterior view, cleared. 12–15. Male, left palpus. 12. Mesal. 13. Ventral. 14. Mesal, expanded. 15. Ventral, expanded.

Scale lines. 0.1 mm, except Figures 1–7, 1.0 mm.

Abbreviations. A. terminal apophysis; C, conductor; E, embolus; H, hematodocha; M, median apophysis; P, paracymbium; T, tegulum.

thon, 15 Dec. 1962, juv. (W. Ivie). *Alabama.* Cherokee Co.; May's Gulfe, 11 Aug. 1948, 13 Oct. 1949, ♀♀ (A. Archer). Tuscaloosa Co.: Tuscaloosa, 2 Oct. 1941, ♀ (A. Archer). *Mississippi.* Forrest Co.: Camp Shelby, 1945–1946, ♀, ♂ (A. Archer). Wilkinson Co.: Centreville, Jan.–July 1944, ♀ (A. Archer). *Arkansas.* Carroll Co.: Berryville, Aug. 1938, summer 1941, Sept. 1944. ♀, ♂ (C. Wilton). *Texas.* Wilbarger Co.: 4 mi NW of Elliott, 21 Oct. 1964, ♂ (K. W. Haller). *Sonora.* Guaymas, on beach, 13 Sept. 1966, ♀ (J., W. Ivie), not mapped, received after completion of paper.

Micrathena Sundevall

Micrathena Sundevall, 1833, Conspectus Arachnidum, London, p. 14. Type species *Epeira clypeata* Walckenaer, the only species listed in "section one" of the genus. The name is feminine. The synonymy problems of generic names are discussed by Bonnet, 1957 (Bibliographia Araneorum, 2: 2858).

Diagnosis. Micrathena females differ from those of other genera in having a smooth, shiny carapace with a light rim on each side (Figs. 18, 31, 45, 59) and in particular, from *Gasteracantha*, by having the carapace longer than wide in the female, at times with pairs of dimples (Fig. 31) or lateral spines (in tropical species) unlike that of any other genera. The female abdomen is usually longer than wide, trapezoidal, or square armed with spines, sclerites and a sclerotized ring around the spinnerets (Figs. 17, 30, 44, 58), while that of *Gasteracantha* is usually wider than long. Males lack the carapace rim and the abdominal spines and have a smooth, sclerotized abdomen with a ring around the spinnerets. The male abdomen is longer than wide, not like that of *Gasteracantha*. The median eyes are never projecting as are those of *Gasteracantha*. The posterior legs of both sexes, especially the femora, are longer than the anterior legs or subequal in length, unlike those of most other araneid genera. The posterior median eyes have the canoe-shaped tapetum reduced to a very narrow, lateral sliver. When viewed through the lens, it may be hidden by the curvature of the eyeball (Figs. 19, 32, 46, 60). The mesal side contains rhabdomes without tapetum, arranged in rows of a variable number of loops, few, perhaps 5 to 6 in number in *M. gracilis* (Fig. 60), about 8 to 9 loops in the other species (Figs. 19, 32, 46). The narrow lateral tapetum is unlike that of most species of Araneidae (Fig. 75). The lateral eyes may be separated from each other by as much as their diameter; the rhabdomes to the sides of the tapetum are not arranged in rows.

Description. The carapace is smooth and shiny in the female and has a unique light rim on each side (Figs. 18, 31, 45, 59). Posterior median eyes are 1.2 to 1.5 times the diameter of anterior medians, laterals subequal or slightly smaller than anterior medians. The median eyes are separated by their diameter to 1.5 diameters. The laterals are several diameters from medians, but may be up to slightly more than their diameter from each other (Fig. 47). The height of the clypeus is equal to or slightly more than the diameter of the anterior median eyes (Fig. 57). The chelicerae are slightly longer than wide, strong with three to four teeth on the anterior margin, three to four on the posterior. The legs are usually not banded. However, sometimes they are slightly lighter in color than the carapace and sometimes slightly granulated (especially the long femora) bearing very short setae. The abdomen is often brightly colored, always modified with spines, tubercles, or folds. The spinnerets are surrounded by a sclerotized ring.

The males are smaller than the females and have the abdomen lightly sclerotized. In the males, it is greater in length than in width, but lacks the spines and tubercles of the female. Thus it is quite difficult to associate with the females of the same species (Figs. 16, 28, 41, 55). The palpal femur lacks the proximal tooth, and there is no facing tooth on the endite. The first coxae sometimes have a hook, sometimes not; the hook is absent in the four species

north of Mexico. The distal articles of the legs may not be modified and only sometimes have macrosetae; in *M. funebris* the first femur has macrosetae on the distal end (Fig. 16).

Genitalia. The epigynum is usually a heavily sclerotized knob with openings at the base of the posterior face (Figs. 21–23, 34–36, 48–50, 62–64). There is no annulate scape. Together with the shape of the abdomen, the epigynum is a diagnostic feature but has been slighted by previous authors.

The palpal patella has one macroseta in *M. funebris*; in *M. gracilis* and *M. sagittata* the macroseta is present, but small. The paracymbium (P in Fig. 40) differs in different species (Figs. 25, 38, 52, 66), unlike other araneid genera but as in *Zygiella*. The bulb lacks a terminal apophysis but has a transparent flap which arises from the base of the embolus (E) and surrounds it. It may be homologous with the missing terminal apophysis (Figs. 27, 40, 54, 68). The embolus tip (E) rests in the conductor (C). The conductor is sometimes a complex sclerite and at its base another sclerite may appear, the paramedian apophysis (PM) (Figs. 40, 68). The median apophysis varies greatly in different species: a sclerotized, split hook in *M. funebris* (M in Fig. 27), the tip sclerotized in *M. mitrata* (Fig. 40), forked in *M. sagittata* (Fig. 54) and reduced in *M. gracilis* (Fig. 68). The sclerites of the palpus are only lightly sclerotized, unlike the sclerotized epigynum, carapace and spines.

Natural History. Micrathena species are diurnal and the spiders rest in the open hub of the orb-web (Plate 1). The spider hangs in a characteristic position, controlling the tension of the web while in the hub. The spinnerets are up, the dorsal surface of the abdomen parallel to the ground (Plate 1) and at an angle to the web plane. The orb has many radii and spirals. No doubt the long fourth legs are an adaptation to the unusual position in the web. Unlike most araneids, *Micrathena* species do not attack-wrap (M. Robinson, personal communication). There is no retreat. All species, north of Mexico, mature in fall in the northern part of their range. Little is known of egg-sacs and life histories.

Distribution. All species known are American. There may be as many as 50 or more tropical American species, with only four extending their range into the temperate area north of Mexico: three in the eastern United States, one in the Southwest (Map 2).

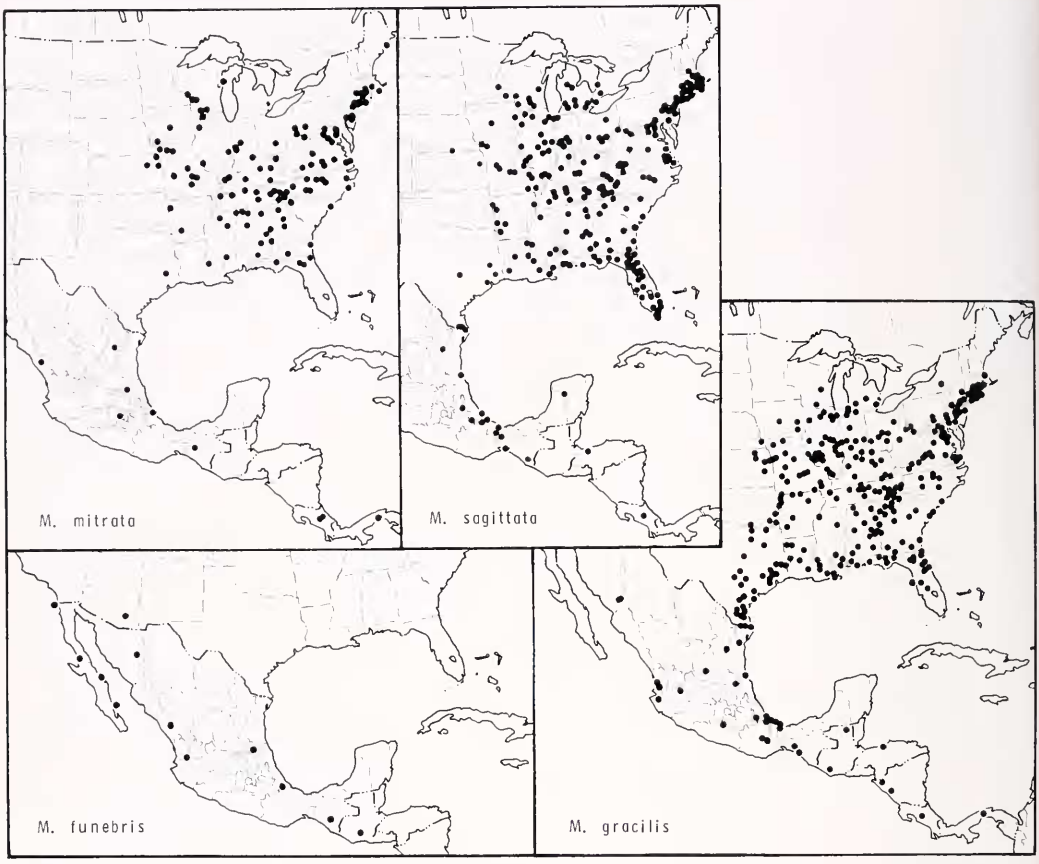
Note. In all species, the genitalia are quite variable, and thus the species are difficult to delineate. The four species north of Mexico, however, are not closely related to each other and are easily separated.

Key to Female *Micrathena* North of Mexico

1. Female abdomen with 5 pairs of conical tubercles (Figs. 58, 59); eastern United States to South America ..... *gracilis*
– Female abdomen with 3 or 2 pairs of spines or tubercles (Figs. 18, 31, 45) 2
2(1) Abdomen with only two pairs of posterior conical tubercles (Figs. 30, 31); carapace with 3 pairs of dimples (Fig. 31); eastern United States to South America (Map 2) ..... *mitrata*
– Abdomen with 3 pairs of tubercles or spines (Figs. 17, 44, 45) and carapace without paired dimples (Figs. 18, 45) 3
3(2) Abdomen much wider behind than anteriorly and with anterior, lateral and large posterior, dorsal spines (Figs. 44, 45); eastern United States to South America (Map 2) ..... *sagittata*
– Abdomen as wide behind as in front without anterior dorsal spines or tubercles, but with dorsolateral, posterior dorsal and posterior ventral tubercles (Figs. 17, 18); Arizona, Baja California to Central America (Map 2) ..... *funebris*

Key to Male *Micrathena* North of Mexico

1. Abdomen wider behind than in front (Fig. 41); median apophysis of palpus with two branches (Figs. 53, M in 54); paracymbium a recurved hook pointing dorsally (Fig. 52); eastern United States to South America (Map 2) ..... *sagittata*
– Abdomen as wide behind as in front (Figs. 16, 28, 55); median apophysis and paracymbium otherwise (Figs. 26, 39, 67) 2



Map 2. Distribution of *Micrathena* species north of Mexico.

2(1) Abdomen more than twice as long as carapace (Fig. 55); posterior end of abdomen longer on venter than dorsum (Fig. 56); eastern United States to South America (Map 2) ..... *gracilis*

– Abdomen less than 1.5 times as long as carapace, not longer on venter (Figs. 16, 28, 29) 3

3(2) First femur with distal macrosetae (Fig. 16); paracymbium with large granulate sculpturing (Fig. 25); median apophysis a semicircular hook on proximal end of bulb (Figs. 26, M in 27); Arizona, Baja California to Central America (Map 2) ..... *funebris*

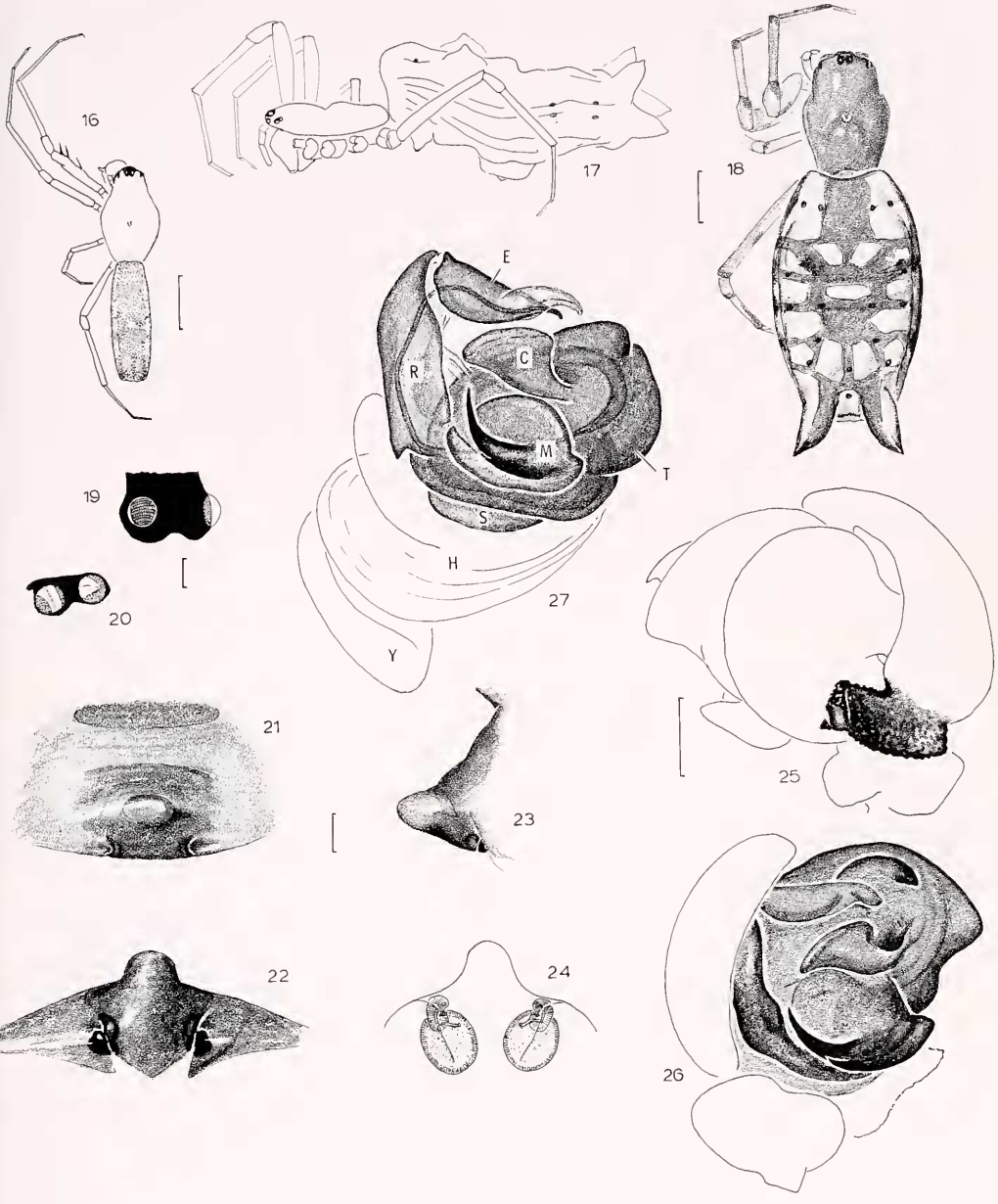
– First femur without distal macrosetae (Fig. 28); paracymbium smooth and small (Fig. 38); median apophysis with distal end pointed and bent back (Figs. 39, M in 40); eastern United States to South America (Map 2) ..... *mitrata*

Micrathena funebris (Marx in Banks) Figures 16–27, Map 2

Acrosoma funebre Marx in Banks, 1898, Proc. California Acad. Sci., 3rd ser., 1(7): 249. Female syntypes from Calmilla Mines and Sierra San Nicholas in the California Academy of Sciences, destroyed; and two syntypes from Mazatlan in the Museum of Comparative Zoology, examined.

Acrosoma maculata Banks, 1900, Canadian Entom., 32: 100. Female holotype from "Arizona" in the Museum of Comparative Zoology, examined. NEW SYNONYMY.

Micrathena granulata F.P.-Cambridge, 1904, Biologia Centrali-Americana, Araneidea, 2: 532, pl. 50, fig. 12, ♂. Male holotype from Teapa, Mexico in the British Museum, Natural History, examined. Reimoser, 1917, Verh. Zool. Bot. Ges. Wien, 67: 117. Roewer, 1942, Katalog der Araneae, 1: 958. Bonnet, 1957, Bibliographia



Figures 16–27. *Micrathena funebris* (Marx in Banks). 16. Male. 17–24. Female. 17. Lateral. 18. Dorsal. 19. Posterior median eyes. 20. Left lateral eyes. 21–24. Epigynum. 21. Ventral. 22. Posterior. 23. Lateral. 24. Posterior, cleared. 25–27. Male left palpus. 25. Lateral. 26. Mesal. 27. Submesal, expanded.

Scale lines. 0.1 mm; except Figures 16–18, 1.0 mm.

Abbreviations. C, conductor; E, embolus; H, hematodocha; M, median apophysis; R, radix; S, subtegulum; T, tegulum; Y, cymbium.

Araneorum, 2: 2870. Chickering, 1961, Bull. Mus. Comp. Zool., 125(13): 423, figs. 78–82, ♂. NEW SYNONYMY.

Micrathena funebris:—Reimoser, 1917, Verh. Zool. Bot. Gesell. Wien, 67: 104. Roewer, 1942, Katalog der Araneae, 1: 958. Bonnet, 1957, Bibliographia Araneorum, 2: 2867. Chickering, 1961, Bull. Mus. Comp. Zool., 125(13): 414, figs. 55–59, ♀.

Micrathena maculata:—Reimoser, 1917, Verh. Zool. Bot. Gesell. Wien, 67: 10. Roewer, 1942, Katalog der Araneae, 1: 967. Bonnet, 1957, Bibliographia Araneorum, 2: 2871. NEW SYNONYMY.

Note. Chickering (1961) already suspected that the male named *M. granulata* belonged to the female *M. funebris.*

Description. Female holotype of *M. maculata.* Carapace brown, sternum black-brown. Legs much lighter, yellow-brown, indistinctly banded darker. Abdomen black with white patches (Fig. 18). The rim of the carapace is brown. Carapace with a circular depression in thorax (Fig. 18). Abdomen soft with four fleshy extensions posteriorly and an anterior pair of humps on each side (indistinct, if viewed from above, Figs. 17, 18). Total length 7.0 mm, carapace 2.3 mm long, 1.6 mm wide. First femur, 2.0 mm; patella and tibia, 2.2 mm; metatarsus, 1.5 mm; tarsus, 0.7 mm. Second patella and tibia, 1.9 mm; third, 0.9 mm. Fourth femur, 2.4 mm; patella and tibia, 2.2 mm; metatarsus, 1.6 mm; tarsus, 0.7 mm.

Male from Sonora: Carapace glossy brown; legs brown. Dorsum of abdomen gray with central white spots and a row of white spots along lateral margins (Fig. 16); sides gray; venter with a plate from pedicel and surrounding spinnerets lightly sclerotized and brownish black. First femur with strong macrosetae at distal end (Fig. 16). Sides of abdomen almost parallel (Fig. 16). Total length 4.1 mm, carapace 1.7 mm long, 1.1 mm wide. First femur, 1.6 mm; patella and tibia, 1.5 mm; metatarsus, 1.0 mm; tarsus, 0.5 mm. Second patella and tibia, 1.4 mm; third, 0.8 mm. Fourth femur, 1.6 mm; patella and tibia, 1.4 mm; metatarsus, 1.1 mm; tarsus, 0.5 mm.

Variation. The palpus of males from southern Mexico and Guatemala differs in having a shorter sclerotized portion of the median apophysis and a more sclerotized paramedian apophysis. Females vary in total length 5.8 to 7.2 mm, carapace 2.4 to 2.6 mm long, 1.5 to 1.7 mm wide. Males vary in total length 4.0 to 4.1 mm, carapace 1.7 to 2.0 mm long, 1.1 to 1.3 mm wide.

Diagnosis. This species is similar to *M. mitrata.* Females differ in their lack of the paired dimples on the carapace (Fig. 18), and the openings of the epigynum are not in a depression (Figs. 22, 24). There is a pair of tubercles anterodorsal on the abdomen (Fig. 17), lacking in *M. mitrata.* The male palpus differs from *M. mitrata* in having a large granulate paracymbium (Fig. 25) and a split sickle-shaped median apophysis on the proximal end of the palpal bulb (Figs. 26, M in 27).

Natural History. Specimens have been collected sweeping weeds at 975 m elevation in Sonora. The webs in Arizona were fairly abundant and were found one to two feet from the ground, attached to stems of Johnson grass (*Sorghum halepense*). They were found near water, at a 825 m elevation (J. Beatty, personal communication).

Distribution. From Baja California and Arizona to Guatemala (Map 2).

Records (north of Mexico). *Arizona.* Pima Co.: Sabino Pond, Santa Catalina Mts., 825 m el. 26 June, 1960, ♀♀; 10 July 1962, ♀♀ (J. Beatty).

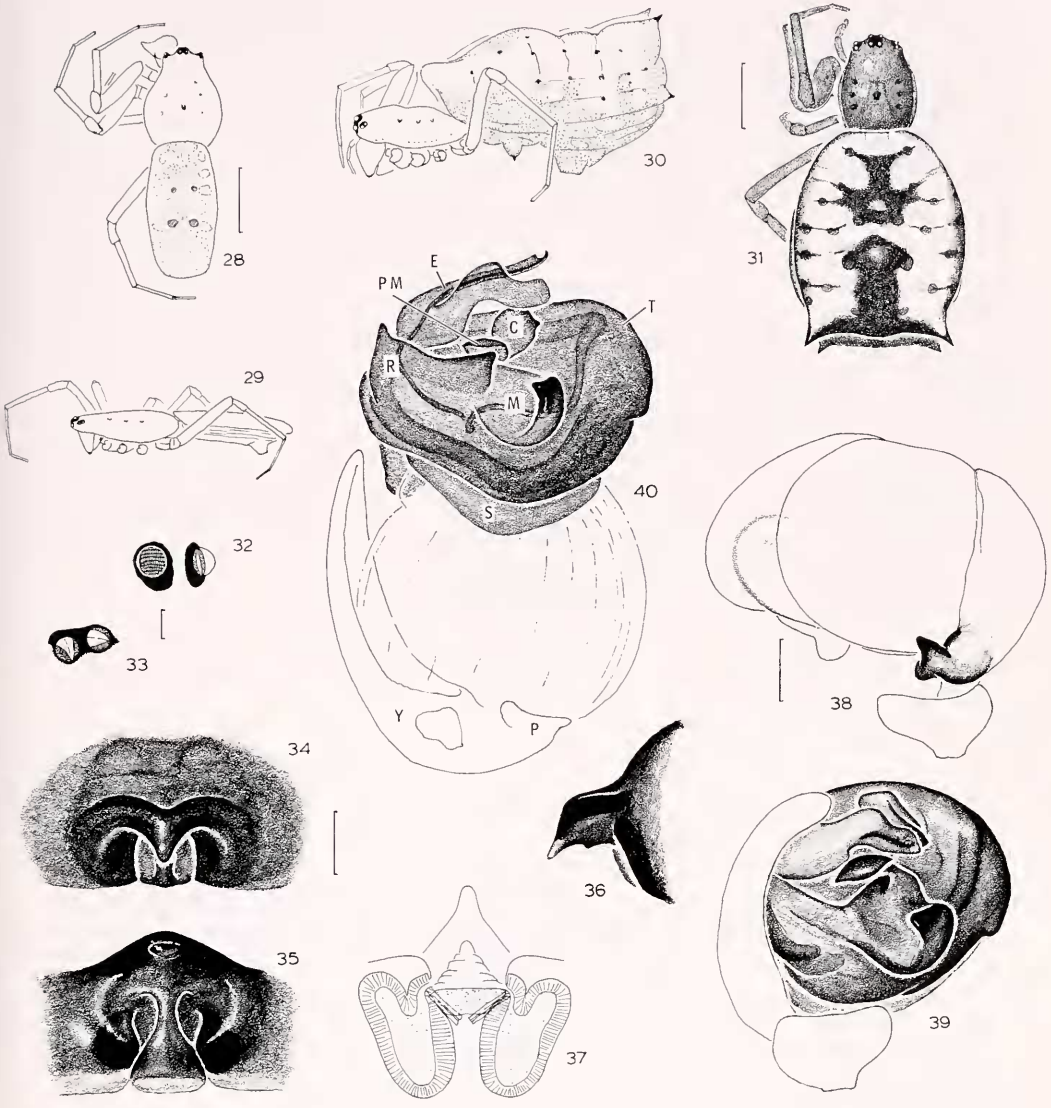
Micrathena mitrata (Hentz)
Figures 28–40, Map 2

Epeira mitrata Hentz, 1850, J. Boston Natur. Hist. Soc., 6: 22, pl. 3, fig. 11, ♀. Syntypes from North Carolina and Alabama in the Boston Society of Natural History, destroyed.

Acrosoma mitrata:—Emerton, 1884, Trans. Connecticut Acad. Sci., 6: 327, pl. 38, fig. 9, ♀. Emerton, 1902, Common Spiders, p. 189, fig. 438. ♀.

Acrosoma reduvianum:—McCook, 1893, American Spiders, 3: 213, pl. 21, figs. 6, 7, ♀, ♂. Not *Plectana reduviana* Walckenaer, 1841 (= *M. gracilis*).

Micrathena mitrata:—F.P.-Cambridge, 1904, Biologia Centrali-Americana, Araneidea, 2: 538.



Figures 28–40. *Micrathena mitrata* (Hentz). 28–29. Male. 28. Dorsal. 29. Lateral. 30–37. Female. 30. Lateral. 31. Dorsal. 32. Posterior median eyes. 33. Left lateral eyes. 34–37. Epigynum. 34. Ventral. 35. Posterior. 36. Lateral. 37. Posteriodorsal. 38–40. Male left palpus. 38. Lateral. 39. Mesal. 40. Submesal, expanded.

Scale lines. 0.1 mm; except Figures 28–31, 1.0 mm.

Abbreviations. C, conductor; E, embolus; M, median apophysis; P, paracymbium; PM, paramedian apophysis; R, radix; S, subtegulum; T, tegulum; Y, cymbium.

Reimoser, 1917. Verhandl. Zool. Bot. Ges. Wien, 67: 104. Roewer, 1942, Katalog der Araneae, 1: 966. Kaston, 1948, Connecticut State Geol. Natur. Hist. Surv., 70: 220, figs. 694–695, ♀, ♂. Bonnet, 1957, Bibliographia Araneorum, 2: 2872.

Micrathena reduviana:—Comstock, 1912, Spider Book, p. 517, fig. 563, ♀. Comstock, 1940, Spider Book, rev. ed., p. 530, fig. 563, ♀. Not *Plectana reduviana* Walckenaer, 1841 (= *M. gracilis*).

Description. Female from Virginia: Carapace brown with white thoracic rim. Sternum dark brown. Legs brown, slightly lighter than carapace. Dorsum of abdomen white with black marks (Fig. 31). Sides white with black marks (Fig. 30). Venter black. There is a thoracic depression and three pairs of dimples on each side of thorax (Fig. 31). Abdomen with four short posterior spines (Figs. 30, 31). Total length 5.0 mm, carapace 1.7 mm long, 1.4 mm wide. First femur, 1.7 mm; patella and tibia, 1.7 mm; metatarsus, 1.2 mm; tarsus, 0.5 mm. Second patella and tibia, 1.4 mm; third, 0.9 mm. Fourth femur, 1.7 mm; patella and tibia, 1.6 mm; third, 1.1 mm; fourth 0.4 mm.

Male: carapace brown, posterior median eyes on black spots. Sternum black. Legs brown. Dorsum black with paired white pigment spots. Venter black. Carapace with three pairs of dimples (Fig. 28). First coxa with a very small hook. Abdomen rectangular in dorsal outline (Fig. 28). Total length 3.5 mm, carapace 1.4 mm long, 1.2 mm wide. First femur, 1.3 mm; patella and tibia, 1.2 mm; metatarsus, 0.9 mm; tarsus, 0.5 mm. Second patella and tibia, 1.0 mm; third, 0.7 mm. Fourth femur, 1.4 mm; patella and tibia, 1.0 mm; metatarsus, 0.8 mm; tarsus, 0.5 mm.

Variation. The dorsal abdominal black marks are smaller in specimens from Guatemala and Panama. Females vary in total length from 4.7 to 6.0 mm long, carapace 1.7 to 2.2 mm long, 1.4 to 1.9 mm wide. Males vary in total length from 3.0 to 3.7 mm, carapace 1.5 to 1.8 mm long, 1.1 to 1.2 mm wide. The largest female came from Mexico.

Diagnosis. Unlike other species north of Mexico *M. mitrata* has three pairs of dimples on the carapace (Fig. 31). The female differs from *M. funebris* in the absence of the anterodorsal tubercle on the abdomen (Fig. 30) and the presence of openings of the epigynum in a depression (Figs. 34, 35). The male palpus has a smaller, differently shaped, smooth paracymbium (Fig. 38), and a median apophysis folded back on itself, its tip sclerotized (Figs. 39, M in 40).

Natural History. Micrathena mitrata is found in deciduous forest, woodland, under trees, sometimes in shrubs and usually in the shade.

Distribution. From Maine to Wisconsin and Kansas, south to Mexico and Panama, but absent from the Florida peninsula (Map 2).

Micrathena sagittata (Walckenaer)
Figures 41–54, Map 2

Plectana sagittata Walckenaer, 1841, Histoire Naturelle des Insectes, Aptères, 2: 174. The name was applied to Abbot illustration of Georgia Spiders, p. 8, fig. 50. Photocopy of the Abbot manuscript in the Museum of Comparative Zoology, examined.

Epeira spinea Hentz, 1850, J. Boston Soc. Natur. Hist., 6: 21, pl. 3, fig. 9, ♀. Syntypes from Atlantic states in the Boston Society of Natural History, destroyed.

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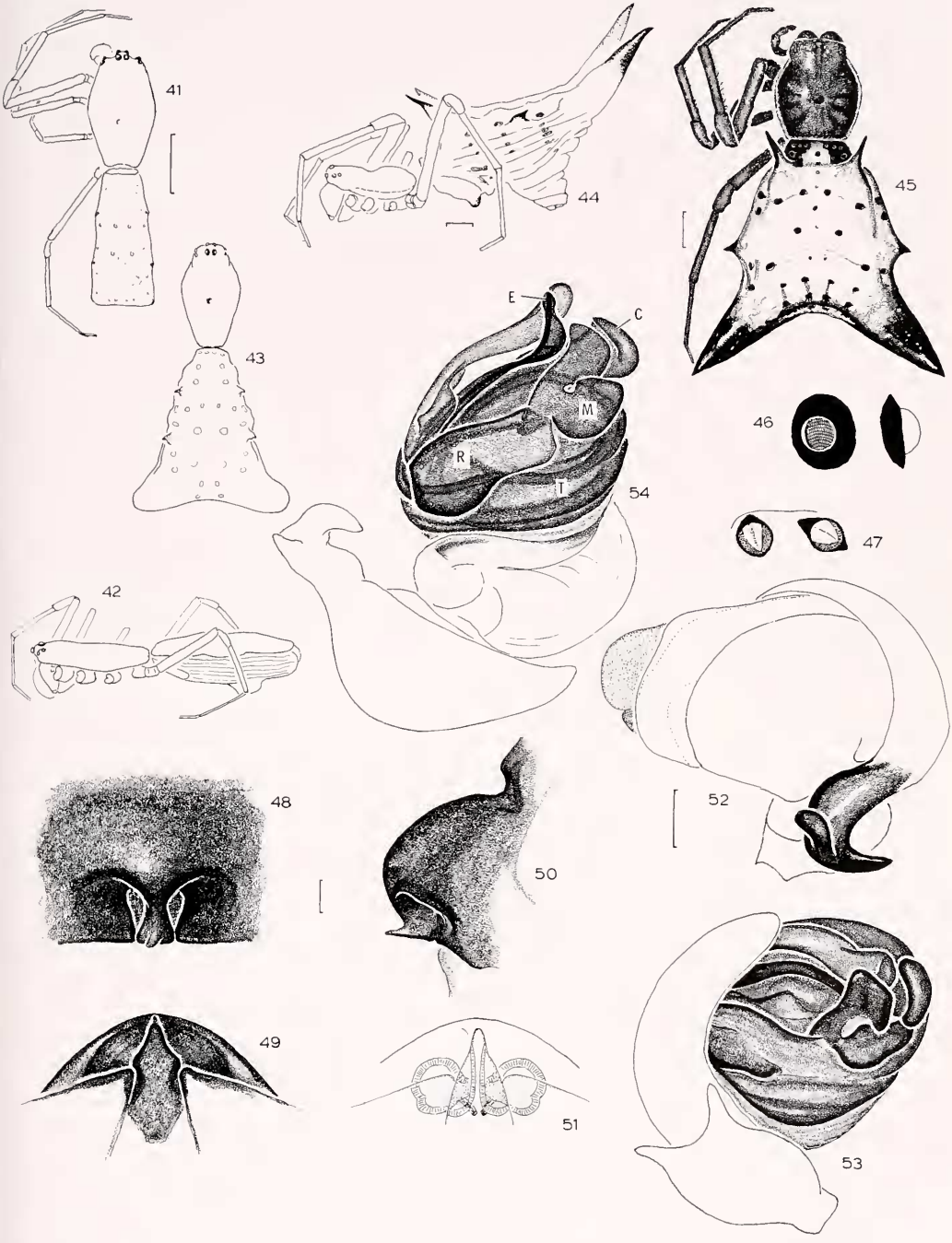
Figures 41–54. *Micrathena sagittata* (Walckenaer). 41–42, Male. 41. Dorsal. 42. Lateral. 43. Subadult male. 44–51. Female. 44. Lateral. 45. Dorsal. 46. Posterior median eyes. 47. Left lateral eyes. 48–51. Epigynum. 48. Ventral. 49. Posterior. 50. Lateral. 51. Posterior, cleared. 52–54. Male left palpus. 52. Lateral. 53. Mesal. 54. Mesal, expanded.

Scale lines. 0.1 mm; except Figures 41–45, 1.0 mm.

Abbreviations. C, conductor; E, embolus; M, median apophysis; R, radix; T, tegulum.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Acrosoma bovinum Thorell, 1859, Oefv. Svensk Vet. Ak. Forh., 16: 301, ♀. Female holotype from Alabama, lost (not in Natural History Museum, Stockholm).

Acrosoma spinea:—Emerton, 1884, Trans. Connecticut Acad. Sci., 6: 326, pl. 38, figs. 5–8, ♀, ♂; 1902, Common Spiders, p. 190, figs. 437, 440–442, ♀, ♂, web.

Acrosoma sagittatum:—McCook, 1893, American Spiders, 3: 214, pl. 21, figs. 8, 9, ♀, ♂.

Micrathena sagittata:—F.P.-Cambridge, 1904, Biologia Centrali-Americana, Araneidea, 2: 536, pl. 51, figs. 20, 21, ♀, ♂. Comstock, 1912, Spider Book, p. 514, figs. 189, 558–561, ♀, web. Reimoser, 1917, Verhandl. Zool. Bot. Gesell. Wien, 67: 140, pl. 9, fig. 29, ♀. Petrunkevitch, 1930, Trans. Connecticut Acad. Sci., 30: 259, figs. 111–114, ♀, ♂. Comstock, 1940, Spider Book, rev. ed., p. 527, figs. 189, 558–561, ♀, web. Roewer, 1942, Katalog der Araneae, 1: 967. Kaston, 1948, Connecticut Geol. Natur. Hist. Surv. 70: 219, figs. 690–693, 2028, ♀, ♂, web. Bonnet, 1957, Bibliographia Araneorum, 2: 2876.

Micrathena comstocki Archer, 1951, Amer. Mus. Novitates, no. 1487: 10, figs. 15–17, ♀. Female holotype from Royal Palm State Park [Royal Palm Area, Everglades National Park], Dade County, Florida in the American Museum of Natural History, examined. NEW SYNONYMY.

Micrathena sagittata emertoni Archer, 1951, Amer. Mus. Novitates, 1487: 10, figs. 18, 22, ♀. Female holotype from Norwell, Plymouth Co., Massachusetts, in the American Museum of Natural History. NEW SYNONYMY.

Description. Female from Virginia: carapace brown, darker on sides of thorax. Sternum, legs brown. Dorsum of abdomen white to yellow with black sclerotized disks; black anteriorly above carapace and posterior spines black (Fig. 45). Sides black with white patches. Venter black around spinnerets, with paired white patches. Abdomen with three pairs of spines, the posterior ones largest (Figs. 44, 45). Total length from between the posterior spines 8.0 mm, carapace 3.1 mm long, 2.5 mm wide. First femur, 3.3 mm; patella and tibia, 3.0 mm; metatarsus, 1.9 mm; tarsus, 0.9 mm. Second patella and tibia, 2.8 mm; third, 1.6 mm. Fourth femur, 3.7 mm; patella and tibia, 3.0 mm; metatarsus, 2.1 mm; tarsus, 0.9 mm.

Male from Virginia: carapace brown. Posterior median eyes on black spots. Sternum, legs brown. Dorsum of abdomen black, white on lateral margin and posterior white marks. Sides black, venter black and brown. Posterior median eyes 1.2 diameters of anterior medians. Laterals subequal to anterior median eyes. Abdomen trapezoidal, dorsoventrally flattened (Fig. 41). Total length 4.7 mm, carapace 1.9 mm long, 1.2 mm wide. First femur, 1.6 mm; patella and tibia, 1.5 mm; metatarsus, 1.0 mm; tarsus, 0.6 mm. Second patella and tibia, 1.2 mm; third, 0.8 mm. Fourth femur, 1.8 mm; patella and tibia, 1.4 mm; metatarsus, 1.0 mm; tarsus, 0.6 mm.

Variation. The abdomen of the female may be white to golden orange in color. The posterior abdominal spines of specimens from southern Florida are longer than those from more northern areas. Interestingly some Mexican specimens have minute posteroventral spines like related tropical species. Females vary in total length 5.4 to 8.6 mm, carapace 2.9 to 3.5 mm long, 2.2 to 2.7 mm wide. Males vary in total length 4.2 to 5.9 mm, carapace 2.0 to 2.5 mm long, 1.3 to 1.6 mm wide.

Diagnosis. Micrathena sagittata females are recognized by having three pairs of spines with the posterodorsals the largest (Figs. 44, 45), and there are no posteroventral spines in specimens north of Mexico as there are in some related tropical species. The openings of the epigynum are in depressions on the posterior face of a bulge (Figs. 48–51). The male, unlike other species of the area, has a trapezoidal abdomen, widest posteriorly (Fig. 41) and a distinct, biforked median apophysis (Figs. 53, M in 54). The paracymbium, unlike that of other North American species, is recurved, pointing back (Fig. 52) with a spur on its side. Juveniles also have a triangular abdomen (Fig. 43).

Natural History. This species is found on shrubs in deciduous forest and woods.

Distribution. From southern New Hampshire to Minnesota, Nebraska, south to Costa Rica.

Micrathena gracilis (Walckenaer)
Plate 1; Figures 55–68; Map 2

Epeira gracilis Walckenaer, 1805, Tableau des Araneides, p. 65. "An unpublished species from Carolina, communicated by M. Bosc."

Plectana gracilis Walckenaer, 1841, Histoire Naturelle des Insectes, Aptères, 2: 193. The name is applied to the Abbot illustration of the Spiders of Georgia nos. 47, 48. Photocopy of the Museum of Comparative Zoology, examined. I consider this the date of the name.

Plectana reduviana Walckenaer, 1841, Histoire Naturelle des Insectes, Aptères, 2: 201. Name for Abbot illustration Spiders of Georgia no. 49. Photocopy in Museum of Comparative Zoology, examined.

Acrosoma matronale C. L. Koch, 1845, Die Arachniden, 11: 68, fig. 887. Female from Mexico, lost (not in Berlin Museum).

Epeira rugosa Hentz, 1850, J. Boston Natur. Hist. Soc., 6: 21, pl. 3, fig. 10. Type from southern states in the Boston Natural History Society, destroyed.

Acrosoma rugosa:—Emerton, 1884, Trans. Connecticut Acad. Sci., 6: 326, pl. 38, fig. 10, ♀; 1902, Common Spiders, p. 189, fig. 439, ♀.

Acrosoma gracile:—McCook, 1893, American Spiders, 3: 212, pl. 21, figs. 1–4, ♀, ♂.

Micrathena matronalis:—Simon, 1895, Histoire Naturelle des Araignées 1: 852, fig. 902, ♀.

Micrathena gracilis:—F.P.-Cambridge, 1904, Biologia Centrali-Americana, Araneidea, 2: 528, pl. 50, fig. 3, pl. 51, fig. 16, ♀, ♂. Comstock, 1912, Spider Book, p. 516, fig. 562, ♀. Reimoser, 1917, Verhandl. Zool. Bot. Ges. Wien, 67: 87, pl. 1, fig. 1, ♀. Comstock, 1940, Spider Book, rev. ed., p. 529, fig. 562, ♀. Roewer, 1942, Katalog der Araneae, 1: 966. Kaston, 1948, Bull. Connecticut Geol. Natur. Hist. Surv., 70: 219, pl. 33, figs. 688, 689, ♀, ♂. Bonnet, 1957, Bibliographia Araneorum, 2: 2868. Chickering, 1961, Bull. Mus. Comp. Zool., 125: 421, figs. 72–77, ♀, ♂.

Micrathena nigrior Chamberlin and Ivie, 1936, Bull. Univ. Utah, biol. ser. 3(5): 58, figs. 134–135, ♀. Four female syntypes from Barro Colorado Island, Panama Canal Zone, in the American Museum of Natural History, examined.

Description. Female from Virginia: carapace brown, darker on sides and middle of thorax. Sternum maculated white and brown. Legs brown. Dorsum of abdomen whitish with dark spots and dark brown sclerotized spots and dark brown spines (Fig. 59). Sides brown with white spots and dark brown sclerotized spots. Thoracic depression small, round (Fig. 59). Dorsum of abdomen with three pairs of spines and two pairs of posteriorly directed spines (Figs. 58, 59). Total length 8.5 mm, carapace 3.0 mm long. 2.2 mm wide. First femur, 2.3 mm; patella and tibia, 2.2 mm; metatarsus, 1.4 mm; tarsus, 0.9 mm. Second patella and tibia, 2.0 mm; third, 1.4 mm. Fourth femur, 2.7 mm; patella and tibia, 2.2 mm; metatarsus, 1.5 mm; tarsus, 0.8 mm.

Male: carapace brown, thoracic region darker. Legs brown. Dorsum of abdomen whitish, venter blackish. There is a round, circular thoracic depression (Fig. 55). Total length 4.8 mm, carapace 1.4 mm long, 0.9 mm wide. First femur, 0.8 mm; patella and tibia, 0.9 mm; metatarsus, 0.6 mm; tarsus, 0.4 mm. Second patella and tibia, 0.9 mm; third, 0.6 mm. Fourth femur, 1.2 mm; patella and tibia, 0.8 mm; metatarsus, 0.5 mm; tarsus, 0.4 mm.

Variation. The species is quite variable in color. Females vary in total length 7.0 to 10.8 mm, carapace 2.6 to 3.7 mm long, 1.7 to 2.5 mm wide. Males vary in total length 4.2 to 5.1 mm, carapace 1.3 to 1.6 mm long, 0.9 to 1.0 mm wide.

Diagnosis. The female can readily be recognized by the often gray abdomen with ten spines (Figs. 58, 59) and by the laterally flattened tip of the cone of the epigynum (Figs. 62–65). The male as well as juvenile males have an elongate abdomen more than three times as long as wide (Figs. 55, 56), the palpus has a round hookshaped paracymbium (Fig. 66), a complex conductor (C) difficult to make out (the basal lobe is probably the paramedian apophysis) and a minute median apophysis with a filamentous attachment (Figs. 67, M in 68).

Natural History. Micrathena gracilis is found in dense woods, the web in shaded areas, often on bushes. A study of the web was published by B. E. Dugdale (1969); the orb observed had 44 radii and about as many spirals. The orb had a radius of 17 cm.

Distribution. The species is found from

eastern Massachusetts, Michigan, Wisconsin, Nebraska, Texas, Sonora, to Panama, absent from southern Florida (Map 2).

Gasteracantha Sundevall

Gasteracantha Sundevall, 1833, Conspectus Arachnidum, p. 14. *Gasteracantha cancriformis* is the type species since the only other species name originally included is *G. hexacantha*, a synonym of *G. cancriformis*. The name is feminine. Dahl, F. 1914, Mitt. Zool. Mus. Berlin, 7: 235–301. Benoit, 1962, Ann. Mus. Royal de l'Afrique Centrale, 8 ser., sci. zool., 112: 1–70. Emerit, 1974, Faune de Madagascar, 38: 1–216.

Vibradellus Chamberlin, 1925, Bull. Mus. Comp. Zool., 67: 214. Type species by original designation and monotypy *V. carolinus* Chamberlin (= *Gasteracantha cancriformis*).

Note. Sundevall cited Latreille, 1831 as author of the name *Gasteracantha*. However, *Gasteracanthe* Latreille (1831 Cours d'Entomologie, p. 530) is a *nomen nudum* since no species are included; it is thus an invalid name since it lacks an indication (ICZN, Art. 16, V). Bonnet (1957) also erroneously cites Latreille (1831) as author.

The list of synonymy of *Gasteracantha* is incomplete; a complete list is found in Emerit, 1974. There are two excellent revisions for the genus available, one of African species by Benoit and one of Madagascan species by Emerit. Both point out that *Gasteracantha* species are generally variable and difficult to separate. But this had been noted previously by Dahl (1914) in his world-wide study.

Diagnosis. The female carapace is almost square in outline (Figs. 71, 72) not longer than wide nor rebordered on the sides as that of *Micrathena*. It is high in front. Unlike related African genera, there is only one transverse row of black discs on the anterior of the abdomen dorsum; the abdomen has one or two pairs of spines laterally and one pair posteriorly (Figs. 71, 72). There is a sclerotized, central bulge on the venter of the abdomen of the female between genital groove and spinnerets, not present in *Micrathena* (Figs. 71, 73). Unlike *Micrathena*, *Gasteracantha* has a large canoe-shaped tapetum in the posterior median eyes (Fig. 75). Together with *Micrathena*, *Gasteracantha* differs from other genera in having the spinnerets on a cone or their base surrounded by a sclerotized annulus (Fig. 73).

Description. Gasteracantha species are brightly colored. The sclerotized, square carapace is high in the head region and has a deep thoracic groove (Figs. 71, 72). The eyes are subequal, small, the anterior median eyes their diameter apart, the posterior medians more than their diameter. All secondary eyes have a canoe-shaped tapetum (Figs. 75, 76). The laterals on each side are far from the medians (Fig. 74). The height of the clypeus equals the diameter of the anterior median eyes (Fig. 74). The heavy chelicerae of *G. cancriformis* have five teeth on the anterior margin, four on the posterior margin. The legs are short and thick, and the tarsi are very short. The female abdomen is a sclerotized shield with sclerotized lateral spines and dorsal sclerotized discs.

Males are minute (Figs. 69, 70, notice different scale) and less often collected. The median eye area is slightly projecting (Figs. 69, 70). The male lacks the tooth on the proximal end of the palpal femur and a tooth on the endite present in many Araneidae. None of the coxae and none of

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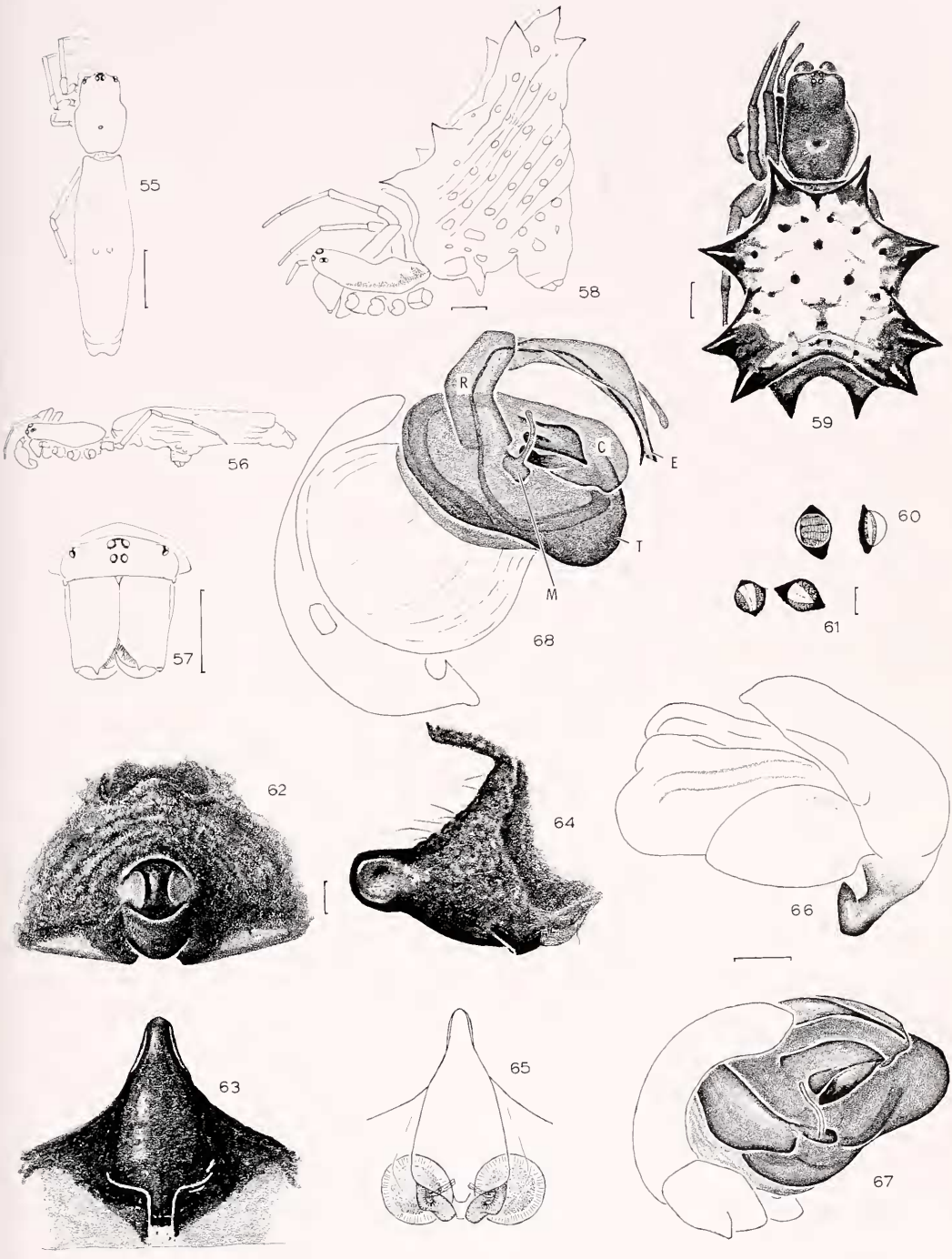
Figures 55–68. *Micrathena gracilis* (Walckenaer). 55–56. Male. 55. Dorsal. 56. Lateral. 57–65. Female. 57. Eye region and chelicerae. 58. Lateral. 59. Dorsal. 60. Posterior median eyes. 61. Left lateral eyes. 62–65. Epigynum. 62. Ventral. 63. Posterior. 64. Lateral. 65. Posterior, cleared. 66–68. Male left palpus. 66. Lateral. 67. Mesal. 68. Mesal, expanded.

Scale lines. 0.1 mm; except Figures 55–59, 1.0 mm.

Abbreviations. C, conductor; E, embolus; M, median apophysis; R, radix; T, tegulum.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the distal articles of the legs are modified. Since the abdomen lacks the prominent spines of the females and also the ventral protuberance, males are difficult to associate with matching females in other parts of the world where there are several species.

Genitalia. The epigynum is a heavily sclerotized projection with a median lobe (Figs. 77–80). The openings can be seen on each side of a septum on the posterior face (Fig. 79). The internal genitalia (Fig. 81) are difficult to make out because of heavy sclerotization.

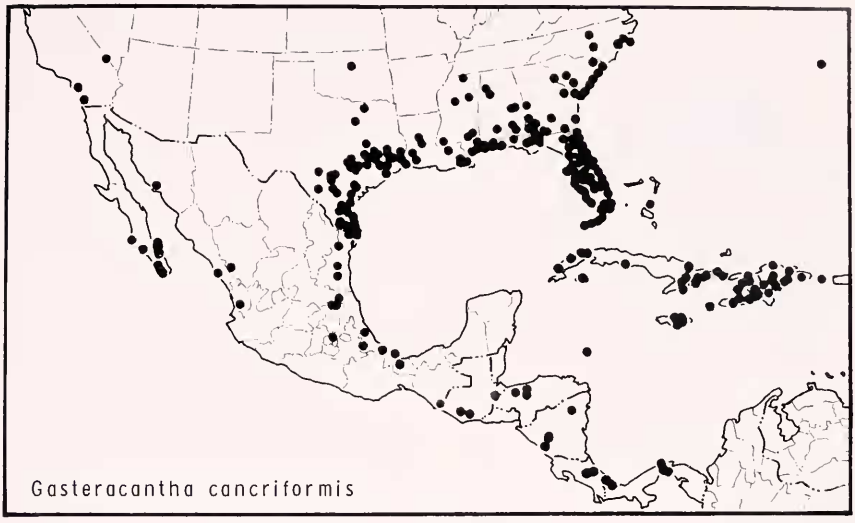
The palpus is relatively simple. In mesal view of the contracted palpus three sclerites are visible: distally the filiform embolus (Figs. 83, E in 84); in the center a round sclerite with its distal edge folded and sculptured, the paramedian apophysis (PM); and proximally the median apophysis (Figs. 83, M in 84). In the expanded palpus (Fig. 84) the radix (R) becomes completely free and transparent hematocha-like material, probably the conductor (C), appears behind the embolus (E). The embolus lacks the parallel lobe (perhaps the terminal apophysis) of *Micrathena.* In the expanded palpus, the paramedian apophysis (PM) slips down and behind the median apophysis (M) as result of pressure from the soft conductor (C) (Fig. 84). The *Mastophora* palpus is similar but lacks a paramedian apophysis (Levi, in press). The palpal patella lacks strong setae. The paramedian apophysis (PM) was called terminal apophysis by Emerit (1968a, 1974). This sclerite is in the same position and of similar appearance as the paramedian apophysis of *Acanthepeira* and other genera (Levi, 1976; in press). The *Acanthepeira* paramedian apophysis is doubtless the same structure as that of the complex palpus of *Eriophora* (Levi, 1970) which was studied by Comstock (1910). The origin of this structure may perhaps be seen in the *Verrucosa* palpus (Levi, 1976, figs. 8, 9) in which it appears to be the basal end of the conductor. It is also close to the conductor in *Wagneriana* and *Wixia* (Levi, 1976, figs. 69–71, 98). The hematodocha-like material (C) behind the embolus (E) is believed to be the conductor, because of similar structures in similar positions in *Acanthepeira*, *Wagneriana*, *Wixia*, and *Scoloderus.* Since *Gasteracantha* lacks a sclerotized conductor and also additional lobes on the embolus (including a terminal apophysis), I believe the palpus to be simplified secondarily.

Relationship. Gasteracantha is close to *Micrathena* and also to *Mastophora.* The structure of the palpus, particularly the lateral (rather than proximal) position of the tegulum (Figs. 83, 84), the mesal position of all sclerites, and the presence of the paramedian apophysis (PM) and conductor suggest close relationship with *Acanthepeira*, *Wagneriana*, *Wixia*, and *Scoloderus* (Levi, 1976). Further indication of a highly specialized araneid are the widely separate eyes, the square carapace (Figs. 71, 72, 74) and the modified structure of the abdomen.

Natural History. Gasteracantha biology is better known than that of many other araneids (*Araneus diadematus* excepted) thanks to the beautiful researches of M. Emerit. His many studies on Madagascan *Gasteracantha versicolor* are listed in Emerit (1974).

Species. Gasteracantha is a cosmotropical genus. As far as we know, there are only one or perhaps two species in America, both known to Linnaeus 200 years ago; *G. tetracantha* (Linnaeus) in the West Indies and *G. cancriformis* (Linnaeus) found from the southern United States to Argentina.

The literature indicates two species in the Americas, both originally described by Linnaeus from Jamaica: *Gasteracantha cancriformis* and *G. tetracantha.* According to the literature, *G. tetracantha* occurs from California and Arizona to the Greater Antilles. The California and Arizona records come from specimens of the George Marx collection, well-known for erroneous



Map 3. North American distribution of *Gasteracantha cancriformis* (Linnaeus).

records. None were found in recent collections and the species probably does not occur in the Southwest. (There is a specimen in the N. Banks collection from "Cal." which probably also originated with Marx.) Although large collections were available from Jamaica, only one species, *G. cancriformis*, is found and the Linnaeus record may also be a locality error. *Gasteracantha tetracantha* occurs in Puerto Rico, the Virgin Islands, and the Bahamas to the north, exactly those areas where *G. cancriformis* is absent. Many specimens appear to be intergrades having six spines and only a few have completely lost the anterior pair. The intergrades come from the north and the Bahamas, not from the west. I hope to obtain more specimens from the region to determine whether there are one or two species in the West Indies.

Numerous names have been given to populations of *G. cancriformis* but as far as I know there are never two different populations overlapping except perhaps in the West Indies. The niche of the numerous African *Gasteracantha* species seems occupied by species of *Micrathena* in the Americas.

Gasteracantha cancriformis (Linnaeus)
Plate 2; Figures 69–84; Map 3

Aranea cancriformis Linnaeus, 1767, Systema Naturae, 12 ed., p. 1037. Specimens described from Jamaica, probably lost.

A. hexacantha Fabricius, 1787, Mantissa Insectorum, 1: 344. Name given with one line of description, but no locality.

Gasteracantha velitaris C. L. Koch, 1838, Die Arachniden, 4: 33, pl. 269, ♀. Female from Brazil.

Plectana clipsoides Walckenaer, 1841, Histoire Naturelle des Insectes, Aptères, 2: 155. Name given to fig. 118, p. 13 of Abbot, Drawings of the Insects of Georgia in America, photocopy examined.

Plectana quinqueserrata Walckenaer. 1841, Histoire Naturelle des Insectes, Aptères, 2: 157. Female from Guyana in Walckenaer's collection, lost.

Plectana sexserrata Walckenaer, 1841, Histoire Naturelle des Insectes, Aptères, 2: 157. Female from Cayenne.

Plectana atlantica Walckenaer, 1841, Histoire Naturelle des Insectes, Aptères, 2: 167. Female from St. Domingo.

Gasteracantha rubiginosa C. L. Koch, 1845, Die Arachniden, 11: 55, pl. 878. Female from St. Domingo, West Indies.

Epeira cancer Hentz, 1850, J. Boston Natur. Hist. Soc., 6: 23, pl. 3, fig. 13, ♀. Females from South Carolina and southern Alabama in the Boston Natural History Society, destroyed.

Gasteracantha insulana Thorell, 1859, Oefv. Svensk

Vet. Akad. Förh., 16: 302. Female from Galapagos Islands in the Natural History Museum, Stockholm, examined.

Gasteracantha columbiae Giebel, 1863, Z. Gesammt. Naturw., 21: 312. A black individual from Colombia, lost (not in Halle (Saale) with the Giebel collection).

Gasteracantha kochii Butler, 1873, Trans. Entomol. Soc. London, p. 169. New name for *G. hexacantha*:—C. L. Koch, 1838, Arachniden, 4, pl. 117, fig. 268. Female from Pará [Belem, Brazil].

Gasteracantha oldendorffi Holmberg, 1876, An. Agric. Rep. Argentina, 4: 143. Female from Noter del Río Guayguiraro, [Entre Rios], Argentina, destroyed.

Gasteracantha callida O.P.-Cambridge, 1879, Proc. Zool. Soc. London, p. 284, pl. 26, fig. 7, ♀. Female holotype from Trinidad, West Indies, in the Hope Museum, Oxford University, Oxford, not examined.

Gasteracantha raimondii Taczanowski, 1879, Horae Soc. Entomol. Rossicae, 15: 106, pl. 1, figs. 25, 26, ♀. Five female syntypes from Lima, Chorillos and Montana de Nancha, Peru, in the Polish Academy of Sciences, examined.

Gasteracantha raimondii unicolor Taczanowski, 1879, Horae Soc. Entomol. Rossicae, 15: 107. Two females from Lima, Peru.

Gasteracantha proboscidea Taczanowski, 1879, Horae Soc. Entomol. Rossicae, 15: 108, pl. 1, fig. 27, ♂. Two male syntypes from Lima, Peru in the Polish Academy of Sciences, examined.

Gasteracantha rufospinosa Marx, 1883, Entomol. Amer., 2: 25, figs. a–f, ♀, ♂. Female and male from Crescent City, Florida, lost (not in National Museum of Natural History).

Gasteracantha maura McCook, 1893, American Spiders, 3: 210, pl. 13, fig. 12, ♀. Numerous syntypes, "young and old from California, particularly the southern part . . . and from the islands off the coast," lost (not in Academy of Natural Sciences, Philadelphia).

Gasteracantha cancriformis:—McCook, 1893, American Spiders, 3: 211, pl. 14, fig. 9, ♀. F.P.-Cambridge, 1904, Biologia Centrali-Americana, Araneidea, 2: 525, pl. 51, fig. 14, ♀. Petrunkevitch 1930. Trans. Connecticut Acad. Sci., 30: 249, figs. 103, ♀, ♂. Comstock, 1940, Spider Book, rev. ed., p. 526, fig. 556, 557, ♀, web. Roewer, 1942, Katalog der Araneae, 1: 949. Bonnet, 1957, Bibliographia Araneorum, 2: 1945.

Gasteracantha elliptica Getaz, 1893, An. Inst. Fis.-geogr. nac. Costa Rica, 4: 105, ♀. Female specimens from around San José, Costa Rica, depository unknown.

Gasteracantha biolleyi Banks, 1905, Proc. Entomol. Soc. Washington, 7: 20, fig. 3, ♀. Female holotype from Cocos Island in the Museum of Comparative Zoology, examined.

Vibradellus carolinus Chamberlin, 1925, Bull. Mus. Comp. Zool., 67: 214, ♂. Male holotype from South Carolina in the Museum of Comparative Zoology, examined.

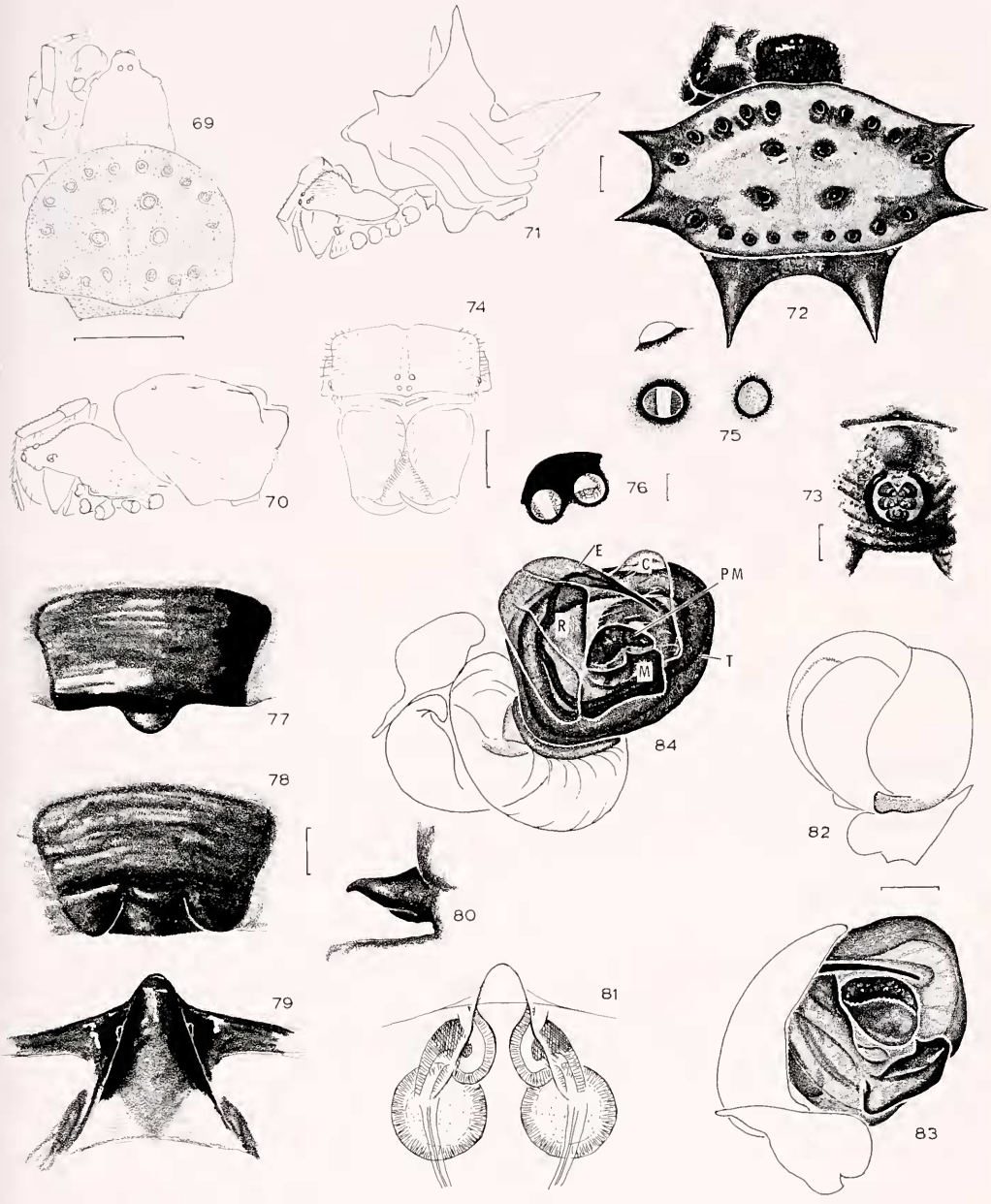
Description. Female from Florida: carapace, sternum, legs brownish black. Dorsum of abdomen whitish, spines orange-yellow, muscle scars black. Venter black with white spots; spines and ventral sclerotized projection, orange. Total length 7.2 mm, carapace 3.2 mm long, 3.0 mm wide. First femur, 2.5 mm; patella and tibia, 2.6 mm; metatarsus, 1.4 mm; tarsus, 0.8 mm. Second patella and tibia, 2.4 mm; third, 1.6 mm; fourth, 2.4 mm.

Male from Florida: carapace brownish black; sternum black. Legs light blackish brown. Dorsum of abdomen dark gray with white spots; venter black with ventral paired white spots. Total length 2.2 mm, carapace 1.1 mm long, 0.9 mm wide. First femur, 0.8 mm; patella and tibia, 0.8 mm; metatarsus, 0.5 mm; tarsus, 0.3 mm. Second patella and tibia, 0.7 mm; third, 0.4 mm; fourth, 0.7 mm.

Variation. There are vast differences in color and shape (Fig. 85). Hispaniola and Jamaican specimens may have an orange carapace and legs. Almost all Florida specimens have orange spines. While black specimens occur occasionally throughout the range, all specimens from Mona Island (west of Puerto Rico) were black with light dorsal patches. Texas specimens were bright yellow in color (washed out in alcohol). The narrowest bodies were found on Mona Island and Jamaica, the widest

→

Figures 69–84. *Gasteracantha cancriformis* (Linnaeus). 69, 70. Male. 69. Dorsal. 70. Lateral. 71–81. Female. 71. Lateral. 72. Dorsal. 73. Abdomen, ventral. 74. Eye region and chelicerae. 77–81. Epigynum. 77. Anteroventral. 78. Ventral. 79. Posterior. 80. Lateral. 81. Posterior, cleared. 82–84. Male left palpus. 82. Lateral. 83. Mesal. 84. Mesal, expanded.



Scale lines. 0.1 mm; Figures 69–74, 1.0 mm.

Abbreviations. C, conductor; E, embolus; M, median apophysis; PM, paramedian apophysis; R, radix; T, tegulum.

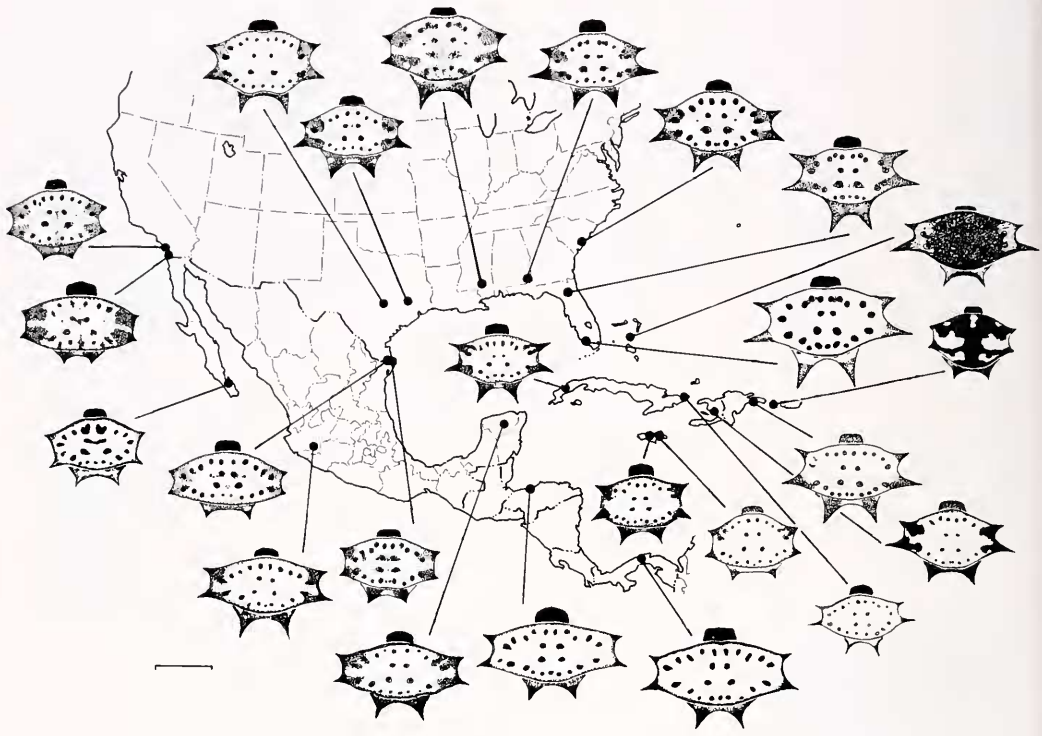


Figure 85. Geographic variation of *Gasteracantha*. Locality data clockwise: Torrey Pines State Park, San Diego Co., California; Laguna Beach, California; Austin, Texas; College Station, Texas; Hattiesburg, Mississippi; Houston Co., Alabama; Charleston, South Carolina; Gainesville, Florida; New Providence, Bahamas; Naples, Florida; Mona Island; La Romana, Dominican Republic; Momance, Haiti; Los Llanos, Cuba; Pinar del Río, Cuba; Port Antonio, Jamaica; Mandeville, Jamaica; Barro Colorado Island, Panama Canal Zone; Carmelina, Honduras; Chichen Itza, Yucatan; Atoyac, Jalisco; Most Southern Palm Grove, Cameron Co., Texas; Brownsville, Texas; La Paz, Baja California.

Scale line: 5.0 mm.

from Texas to Central America. The shortest stubbiest spines are found in Mona Island and California; the longest ones in Florida and the southeastern states. The most acute spines are found in Cuban specimens. A characteristic of Hispaniola and southern Florida specimens is that the second pair of spines is larger than the first pair. Since there are clines of these characters in various directions, it is not easy to segregate subspecies except for island populations.

Unusual variations are the additional round plates found at times on the dorsum of the abdomen. The specimen from Laguna Beach, California illustrated (Fig. 85) has an extra assymmetrical plate on the left anterior. Many specimens throughout the North American range have the median posterior plate split into two plates (Texas, South Carolina, and Dominican Republic, Fig. 85).

Total length of females is 5.8 to 8.6 mm, carapace 2.3 to 3.1 mm wide. Total length of males 1.9 to 2.7 mm, carapace 0.8 to 1.0 mm wide. Size variation is about the same throughout the southern states.

Species problems. Archer judging by museum labels, considered specimens from the western states to be *G. servillei* (Guérin)

and those from the eastern states to be *G. cancriformis*, with several subspecies. However collections from Austin, Texas had both specimens which Archer considered to belong to the western species and to the eastern species. Since there is no overlap of the two forms, but instead intermediates are found, I consider all to belong to one species. The eastern specimens were considered by Archer (unpublished) to belong to several different subspecies, but almost as many were labeled as intermediates (e.g. from northern Florida), as belonging to the subspecies.

Diagnosis. Females can be distinguished from West Indian *G. tetracantha* (Linnaeus) by the presence of six spines on the abdomen (Figs. 71, 72); *G. tetracantha* has only four. Males of *G. tetracantha* have the sclerites of the palpus, especially the paramedian apophysis, relatively smaller than those of *G. cancriformis* (Figs. 83, 84), although all parts are of the same shape.

Natural History. The striking appearance, conspicuous webs and diurnal habits make this one of the easily collected tropical spiders. The web is found between branches on shrubs and even on buildings (Plate 2). It is made in the morning and is usually inclined at an angle, sometimes near vertical (Plate 2). The outer threads are decorated with flocculent tufts of silk (Marples, 1969) and the spider rests in the open hub. Young Madagascan *Gasteracantha versicolor* may have a stabilimentum (Emerit, 1968b).

Adult males have been collected in Florida from November to February; in Alabama in August; in Texas in April, June, July, and October and in California during July. Adult females can be collected throughout the year in Florida and Texas.

Muma (1971) found *Gasteracantha cancriformis* webs in central Florida orchards in trees, between trees and also in mixed mesophytic woods at a height of less than 1 to more than 6 m. The female's web has 10 to 30 spiral lines, the viscid area spanning 30 to 60 cm diameter. The prey caught are flies, moths, and beetles. The spider completes the life cycle in a year. Females mature in late fall or early winter and are found from October to January. Adult males first appear in October and November when females are one-third to one-half adult size. Adult males hang from a single strand of silk adjacent to a female's web, one to three per web. The tiny males accomplish sperm induction just prior to courtship. Egg-sacs are flattened ovate masses of tangled white, yellow, and green silk, marked with a longitudinal stripe of dark green silk. They are found on the underside of leaves adjacent to the webs.

Distribution. Gasteracantha cancriformis is found from North Carolina to Southern California south to northern Argentina (Map 3). Specimens occasionally get transported; one female was found among fruit in Seattle.

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